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(71) Applicant: **CORDIS EUROPA N.V.**
NL-9301 LJ Roden (NL)

(72) Inventors:
- **Van Werven-Franssen, Gerda Hendrika Maria**
  9301 EK Roden (NL)
- **Ligtenberg, Hendrikus Cornelis Geert**
  9351 PX Leek (NL)
- **Haan, Marcel Gerhard**
  9312 PE Nietap (NL)
- **Leone, James Ernest**
  33156 Miami, Florida (US)

(74) Representative: **'t Jong, Bastiaan Jacobus**
Arnold & Siedsma,
Advocaten en Octrooigemachtigden,
Sweelinckplein 1
2517 GK Den Haag (NL)

(54) Balloon catheter with a single lumen and assembly of such a catheter and a light conductor

(57) The invention relates to a catheter comprising a tube-like basic body with a proximal and a distal end. The catheter is provided with a single lumen and a balloon member made of light-transmitting material. The balloon member has been arranged with an end-section to the distal end of the basic body and the opposite, relatively distal end-section thereof is closed.
The invention also relates to an assembly of a catheter and a flexible rod-shaped light conductor which comprises light conducting material and has a smaller diameter than the lumen of the basic body and a greater length than the catheter.

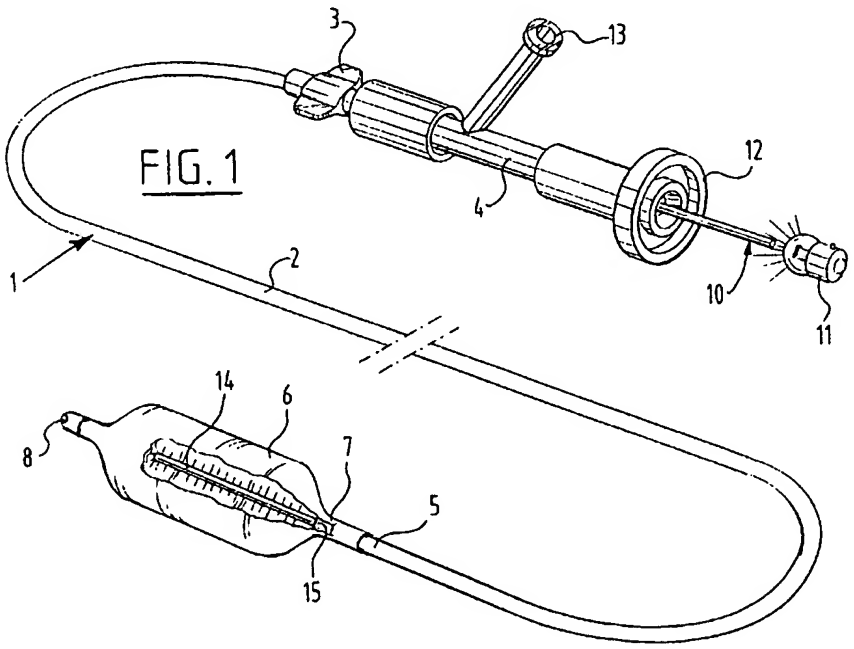

FIG. 1

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Description

The invention relates to a balloon catheter particularly intended for the fitting of a stent, made of a plastic material curing due to the action of light, in particular the action of UV-light, inside a blood vessel of a patient.

The balloon catheter according to the invention comprises a tube-like basic body with a proximal and a distal end, known as such. The basic body is provided with a single lumen. A balloon member made of light-transmitting material has been arranged with one of its ends to the distal end of the basic body. The opposite, relatively distal end-section of the balloon member is closed. The basic body consequently ends at the beginning of the balloon, so that the inside of the balloon is free of a tube-like element.

The catheter can be inserted into the patient and its balloon can be placed in the required position by introducing a stiff guide wire through the lumen, until the end of the guide wire is placed against the distal end of the balloon member, and stretches the latter in line with the basic body. After placing the balloon in the right position, the guide wire is removed and a light conductor, in particular an optic fibre bundle, is introduced via the lumen of the basic body. The end of this optic fibre bundle has been treated in such a manner that light, which is admitted into the proximal end of the fibre bundle, is emitted in a radial direction at the distal end situated inside the balloon. This can be achieved by providing the proximal end of the light conductor with a somewhat roughened surface, for instance by means of grinding. This end-section can be made of solid light-conducting material, whereas the section extending from that end-section to the proximal end-section is made of an optic fibre bundle.

With the radially emitted light a stent, made of a plastic material which cures under the action of light, and which is expanded by the balloon, can be cured so that it retains its ultimate expanded shape. A suitable material for the plastic stent is a material which cures under the action of UV-light. UV-light is supplied, via the light conductor, from the proximal end to the site of the stent. An advantageous embodiment is characterised in claim 2. In that case the catheter can be introduced by passing it over a guide wire, despite the closed relatively distal end of the balloon member.

The invention relates to and also provides an assembly of a balloon catheter with a single lumen and a flexible rod-shaped light conductor. The light conductor has a smaller diameter than the lumen of the basic body and a greater length than the catheter, so that it can extend through the lumen from outside the proximal end of the catheter to inside the balloon member thereof.

A preferred embodiment is characterised in claim 4. On introducing the catheter, it is the light conductor which straightens the balloon member and keeps it in line with the basic body. At the same time this embodiment ensures that the distal end of the light conductor is placed in the right position inside the balloon member, so that one can be certain that the light is supplied to the right place.

In order to be able to advance the balloon to the correct position inside the body of the patient, the measure as set out in claim 5 is preferably employed.

A suitable embodiment is characterised in claim 6. If the stent itself is also visible under NMR-conditions and /or when using X-radiation, for instance by incorporating a suitable filler in the plastic material of which the stent has been made, the relative position of the working end of the light conductor in relation to the stent can be looked at and checked carefully in a catheterization laboratory.

The invention will be explained in greater detail in the following description with reference to the attached drawings.

Figure 1 shows a partly broken away perspective view of an assembly of a catheter according to the invention and a light conductor.

Figure 2 shows the balloon member of the catheter of figure 1 when positioning a stent.

Figure 3 shows the distal end-section of another embodiment of the catheter according to the invention.

Figure 4 shows yet again another embodiment of the catheter.

The assembly illustrated in figure 1 comprises a catheter 1 with a light conductor 10 received inside it.

The catheter 1 comprises a tube-like basic body 2 with one single lumen 15. At the proximal end, that is to say the end which remains outside the body of the patient during treatment, a connecting member has been arranged in the form of a Luerlock-connection, known as such. The connecting member 3 is connected with a haemostatic device 4, known as such, which will be explained in greater detail below.

At the distal end 5 of the basic body 2 a balloon member 6 has been arranged. The relatively proximal end-section 7 has been arranged on the distal end 5 of the basic body 2. The opposite, relatively distal end 8 of the balloon member 6 is closed. Consequently the inside of the balloon member 6 is free of the basic body 2.

The haemostatic device 4 comprises in the usual manner a central channel which is connected with the lumen of the catheter connected to it. Through the connection 12, an elongated element, in this case a light conductor 10, can be introduced in a sealed manner. Via the connection 13 liquid or gas under pressure, for the purpose of expanding the balloon member 6, can be supplied.

The light conductor 10 has been made in such a way that the light which is admitted into the proximal end by a source of light 11, schematically illustrated in figure 1, is emitted in a radial direction at the distal end 14. As a result it is possible to conduct light from the proximal

end of the assembly to the balloon member 6.

The assembly of figure 1 is used for instance for the purpose of fitting a stent, made of a plastic material curing under a certain type of light, inside a blood vessel. This has been schematically illustrated in figure 2.

The blood vessel 20 is for instance locally impaired, and this impairment is to be reinforced by means of a stent 21. The stent 21 used, has been made of a plastic material which cures due to the action of light, in particular UV-light. The stent 21 is introduced into the patient in compressed state, arranged around the balloon member 6. By means of the marking rings 9, arranged on either side of the balloon member 6, the position of the balloon member and consequently that of the stent 21 can be visualized on for instance an X-ray screen. On introduction a stiff guide wire is for example used instead of the light conductor 10, which is positioned with its distal end against the relatively distal end 8 of the balloon member 6, so that the balloon member is stretched on introduction.

As soon as the stent is placed in the correct position, the guide wire is replaced by the light conductor 10 and liquid under pressure is supplied via the connection 13 in the haemostatic device, as a result of which the balloon 6 and consequently the stent 21 will expand. Next the source of light 11 is activated and the stent exposed to the light emitted radially from the end 14 of the light conductor 10. After a certain exposure time, the duration of which has been established experimentally as being sufficient to cure the stent, the light source 11 is switched off and the pressure inside the balloon 6 drained off; as a result the balloon will contract and the catheter can be removed completely, leaving the expanded stent in situ.

Figure 3 illustrates a somewhat different embodiment of the catheter according to the invention. In this case the balloon 25 has been provided with a separate end-section 26 at its relatively distal end, in a depression of which the distal end 28 of a light conductor 27 has been fixed, for instance by glueing. The light conductor 27 thus forms a unit with the catheter and provides a certain bending stiffness at the balloon member 25, which enables the introduction of the catheter and in particular the balloon member thereof. The light conductor 27 is provided with two marking rings 29, which visualize the position of the balloon on for instance an X-ray screen. The light conductor 27 extends through the single lumen 30 of the basic body of the catheter and can be moved inside it.

With the embodiment of figure 4 the balloon member 35 is provided at its relatively distal end with a tube-like end- section 36, which extends over a certain distance in front of the balloon 35. This tube-like end-section 36 has been provided with a guiding lumen 37 which extends from the tip to an opening 38 in the wall of the end-section 36 close to the balloon 35. Through this channel 37 a guide wire 39 can be advanced, over which a catheter can be passed and introduced into a patient. Also with this embodiment the basic body 40 does not extend further than the relatively proximal end of the balloon member 35.

Claims

1. Catheter comprising a tube-like basic body with a proximal and a distal end and provided with a single lumen, a balloon member made of a light-transmitting material, which has been arranged with an end-section to the distal end of the basic body and of which the opposite, relatively distal end-section is closed.

2. Catheter as claimed in claim 1, wherein a tube-like end-section of a catheter comprising a guide wire lumen which extends from the distal end to an opening in the lateral wall close to the balloon member, is connected with the relatively distal end of the balloon member.

3. Assembly of a catheter as claimed in claim 1 or 2 and a flexible rod-shaped light conductor which comprises light conducting material and has a smaller diameter than the lumen of the basic body and a greater length than the catheter.

4. Assembly as claimed in claim 3, wherein the light conductor extends from the proximal end through the lumen to the relatively distal end of the balloon member and has been fixed to this end.

5. Assembly as claimed in one of the previous claims, wherein close to the opposite end-sections of the balloon member marking elements have been arranged which are visible under NMR-conditions and/or when using X-radiation.

6. Assembly as claimed in claim 5, wherein the marking elements have been arranged to the light conductor.

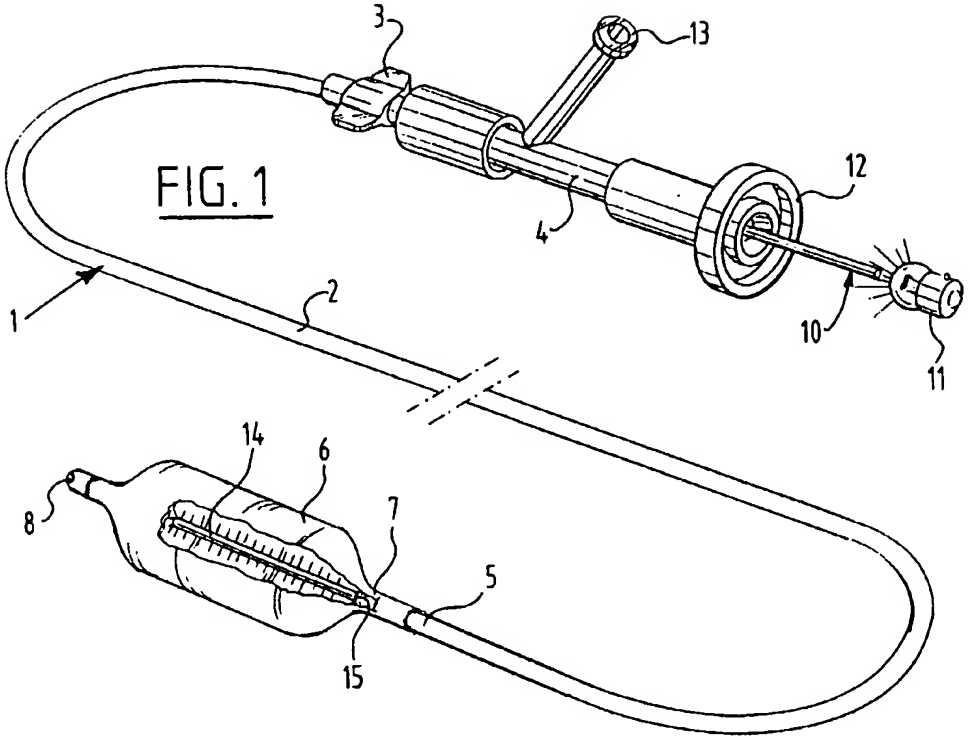

FIG. 1

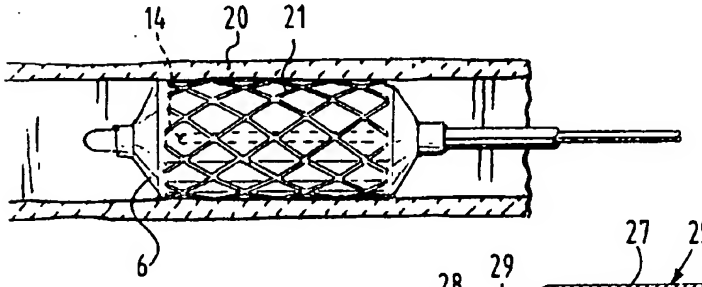

FIG. 2

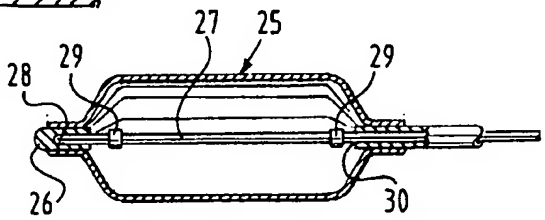

FIG. 3

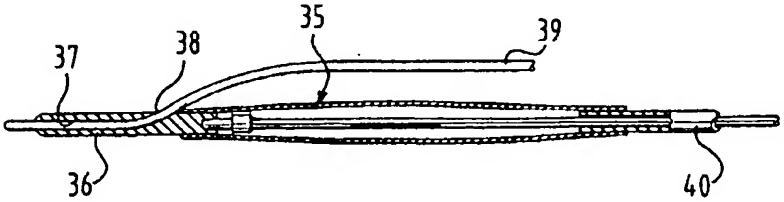

FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 96 20 0666

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X Y	EP-A-0 311 458 (SINOFSKY) 12 April 1989 * column 9, line 49 - column 11, line 33; figures *	1,5,6 2-4	A61F2/06 A61B17/36
Y	EP-A-0 611 582 (DATASCOPE) 24 August 1994 * column 11, line 9 - line 20; figure 12 *	2	
Y	WO-A-83 03188 (LASERSCOPE) 29 September 1983 * page 6, line 11 - page 8, line 12; figures *	3,4	
P,X	EP-A-0 646 360 (S.L.T. JAPAN) 5 April 1995 * abstract; figure 1 *	1	
A	US-A-4 773 899 (SPEARS) * column 4, line 28 - line 57; figures *	1,3	
A	US-A-5 125 925 (LUNDAHL) * abstract; figures *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

A61F
A61B
A61M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	8 May 1996	Kousouretas, I

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